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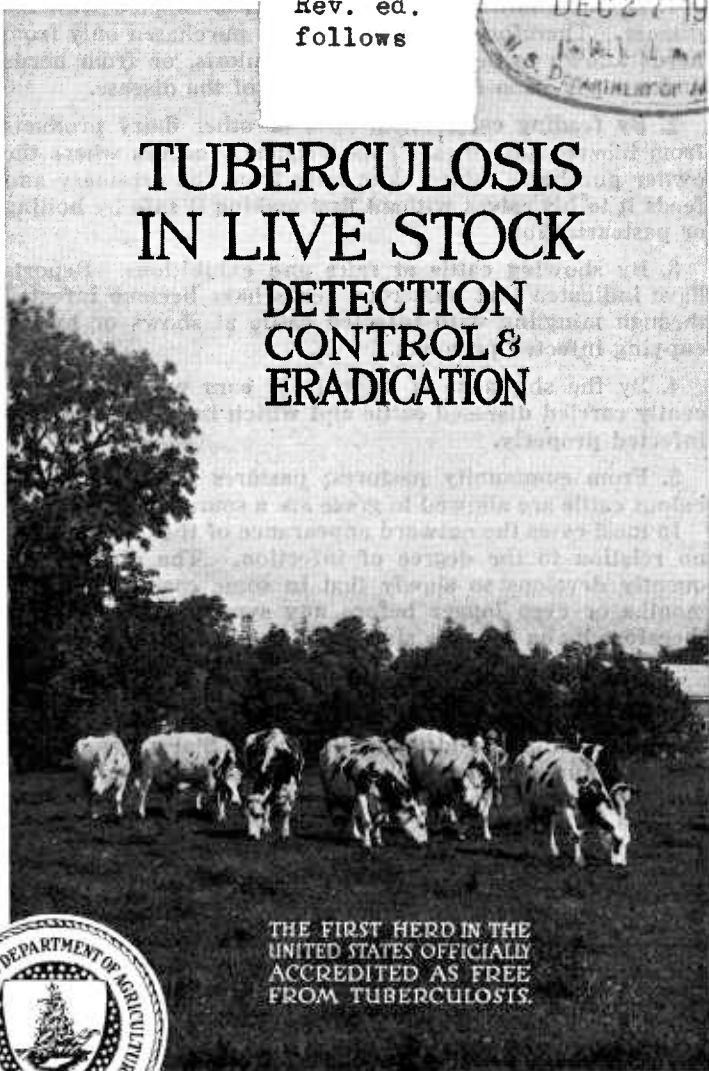
U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1069

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TUBERCULOSIS IN LIVE STOCK DETECTION CONTROL & ERADICATION



THE FIRST HERD IN THE
UNITED STATES OFFICIALLY
ACCREDITED AS FREE
FROM TUBERCULOSIS.



HOW TUBERCULOSIS SPREADS FROM A DISEASED HERD TO A HEALTHY ONE

TUBERCULOSIS may be introduced into a healthy herd by any of the following means:

1. By the addition of an animal that is affected with the disease. Therefore animals should be purchased only from herds known to be free from tuberculosis, or from herds under supervision for the eradication of the disease.

2. By feeding calves with milk or other dairy products from tuberculous cows. This frequently occurs where the owner purchases mixed skim milk from the creamery and feeds it to his calves without first making it safe by boiling or pasteurization.

3. By showing cattle at fairs and exhibitions. Reports have indicated that numerous herds have become infected through mingling with infected cattle at shows or by occupying infected premises.

4. By the shipment of animals in cars which have recently carried diseased cattle and which have not been disinfected properly.

5. From community pastures; pastures in which tuberculous cattle are allowed to graze are a source of danger.

In most cases the outward appearance of the animal bears no relation to the degree of infection. The disease frequently develops so slowly that in some cases it may be months or even longer before any symptoms are shown; therefore be on the safe side and have your herd tested.

COOPERATIVE WORK FOR TUBERCULOSIS ERADICATION

Tuberculosis eradication is a cooperative work of the Bureau of Animal Industry of the United States Department of Agriculture, the livestock sanitary officials of the various States, and individual cattle owners.

TUBERCULOSIS IN LIVESTOCK

DETECTION, CONTROL, AND ERADICATION

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PRESENT KNOWLEDGE OF TUBERCULOSIS

PROBABLY no disease affecting either the human race or livestock is better known or has been the object of so much study as tuberculosis. Present knowledge of the disease is derived from many sources, including the work of eminent scientists who discovered its cause, and studies of the numerous ways in which it is spread, of the manner by which man and animals contract it, and the effects it produces.

The tuberculin test—the means of detecting tuberculosis—was devised in 1890 by the eminent scientist, Dr. Robert Koch. Thus the test has been known for more than a third of a century. The facts regarding it and other information presented in this bulletin are based on long experience and results verified many times. The methods recommended to be used in the eradication of tuberculosis have been tried on large numbers of herds and found to be effectual and practicable.

EARLY ERADICATION IS MOST ECONOMICAL

Livestock owners are earnestly requested not to wait until State and Federal officers come into their localities to eradicate tuberculosis. In almost every locality of the United States are veterinarians capable of rendering valuable services to livestock owners in this great work, and the cost of eradicating is greatly reduced by combating the disease in its early stages. Yet even in badly affected herds eradication can be undertaken with success. There

¹ Doctor Kiernan died in December, 1927, and Doctor Wight became chief of division on Jan. 1, 1928.

spective States and the Federal Government. The area over which tuberculosis has spread is too vast, the herds are too numerous, and funds are insufficient for conducting the work on so extensive a plan, even though trained veterinarians were available in sufficient numbers to do the work. Every livestock owner should be a party to this campaign which has been inaugurated to eradicate tuberculosis. In almost every locality of the United States are veterinarians capable of rendering valuable services to livestock owners in this great work, and the cost of eradicating is greatly reduced by combating the disease in its early stages. Yet even in badly affected herds eradication can be undertaken with success. There are records of many herds, in which three-fourths of the animals were affected with tuberculosis, which eventually were freed from it and afterwards maintained in a healthy condition.



FIG. 1.—Portion of a herd of 45 cattle showing no external symptoms of tuberculosis. On application of the tuberculin test, 37, or 82 per cent, of the animals were found to be tuberculous. The germs of the disease may live for months in manure or litter

The extirpation of tuberculosis from livestock is important not only from an economic standpoint, but also because a considerable percentage of tuberculosis in the human family, especially among children, is positively due to the consumption of infected milk or other dairy products from tuberculous cows. It is eminently proper for the respective State governments to expend funds for the maintenance of tuberculosis sanitariums for the care of persons afflicted with that disease, and likewise it is extremely important to use vigorous measures to check the marketing of germ-laden milk. While it is true that proper pasteurization of milk destroys the living organisms of tuberculosis, a large part of the milk consumed daily is not pasteurized, and some of the milk so treated is not always made entirely safe.

TUBERCULOSIS A DECEPTIVE DISEASE

If tuberculosis were similar to foot-and-mouth disease in cattle, swine, and sheep, which causes rather spectacular symptoms, it would arouse immediate alarm among the livestock owners, who would insist upon its immediate eradication; but because it is generally slow in developing and its symptoms commonly are not easily recognized from the general outward appearance of the animals (see fig. 1), many people believe that it does comparatively little damage among livestock. Contrary to such opinions, however, the loss from tuberculosis is one of the heaviest taxes imposed upon our livestock industry, amounting, probably, to at least \$40 000,000 a year in the United States.

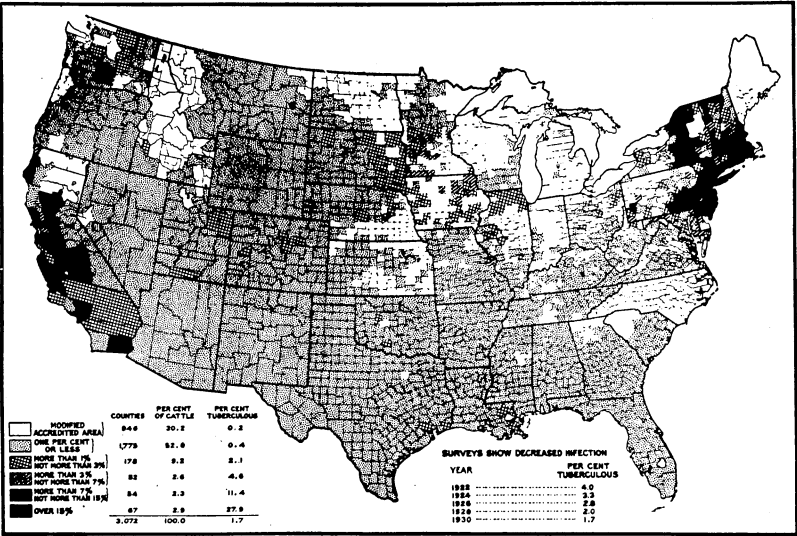


FIGURE 2.—Extent of bovine tuberculosis in the United States, May 1, 1930

PREVALENCE OF TUBERCULOSIS

In every State and Territory in the Union there is some tuberculosis among cattle and swine, though the degree varies considerably. An estimate of the extent of bovine tuberculosis is given in Table 1 and shown graphically in Figure 2.

TABLE 1.—Estimated percentage of bovine tuberculosis in the United States (May 1, 1930)

Extent of infection	Area affected				Cattle in area	Degree of infection (per cent reactors)
	Counties		Square miles			
	<i>Num- ber</i>	<i>Per cent</i>	<i>Number</i>	<i>Per cent</i>	<i>Per cent</i>	
Modified accredited area (0.5 per cent or less by actual test)-----	946	30.8	686,197	23.1	30.2	0.2
0 to 1 per cent.-----	1,775	57.7	1,960,765	65.9	52.8	.4
Over 1 to 3 per cent.-----	178	5.8	181,899	6.1	9.2	2.1
Over 3 to 7 per cent.-----	52	1.7	38,772	1.3	2.6	4.6
Over 7 to 15 per cent.-----	54	1.8	62,347	2.1	2.3	11.4
Over 15 per cent.-----	67	2.2	43,796	1.5	2.9	27.9
Total or average-----	3,072	100.0	2,973,776	100.0	100.0	1.7

Tuberculosis is known to exist also quite extensively among cattle and swine in all the European countries; in fact, no part of the world is known to be absolutely free from it. There are, however, some restricted regions where its presence is not known or it exists to but a very moderate degree.

Until cattle from the eastern part of the United States were introduced into the Middle Western, Western, and Southern States tuberculosis among livestock in those regions was unknown so far as we know. The disease at that time was confined to the herds east of the Allegheny Mountains. It was known then that a considerable percentage of herds in those States were affected, but livestock owners were not inclined to consider tuberculosis as of very great economic importance or dangerous to human health. Therefore very little progress was made in its eradication. As the Central and Western States became settled and cattle were moved westward the disease spread much more rapidly than is generally realized. The spreading in those areas is due, of course, to the fact that the livestock industry occupies a more important part in agriculture than in the Eastern States. Cattle are traded in more extensively and are continually being shipped and trailed from State to State and from farm to farm.

In some localities in the West where dairying has developed extensively it is now known that carload lots of cows purchased in other States have contained 50 per cent or more of tuberculous animals. Some herds of beef cattle in our western country have become contaminated with the disease by placing among them tuberculous purebred bulls and cows that came from diseased herds elsewhere. The importance of controlling tuberculosis and preventing its spread by the interstate movement of diseased animals was not so well recognized during the times of pioneer development as it is to-day. Consequently, in the absence of regulations and inspection, diseased animals moved from one State to another. The shipment of cattle from Eastern and Northern States to the South, with the exception of dairy herds near the larger cities, did not commence until progress had been made in the eradication of the cattle tick. Therefore there is probably less tuberculosis among the herds of the Southern States than in any other part of the Nation. This favorable condition should be taken advantage of, for in all probability the livestock industry will reach a high development in that area in future years. It is especially important that the herds of the Southern States be protected by permitting only tuberculosis-free animals to enter.

LOSSES OF MEAT FOOD PRODUCTS

Records kept by the Meat Inspection Division of the Bureau of Animal Industry show the great financial loss caused by tuberculosis every year. They also indicate how widespread tuberculosis in cattle and swine is in the United States, as the establishments in which the diseased animals were slaughtered are in all parts of the country. More than that, only about 65 per cent of the cattle and swine, it is estimated, are slaughtered each year in establishments under Federal supervision, so that about 35 per cent of these classes of animals slaughtered each year in the United States do not appear in these

records. It is probable also that the percentage of tuberculosis is greater in the uninspected animals. In view of these considerations the losses shown in Table 2 are believed to be considerably less than the total loss throughout the country.

TABLE 2.—*Number of cattle and swine slaughtered, and those retained and condemned on account of tuberculosis, at establishments where Federal meat inspection is maintained*

Fiscal year	Cattle			Swine		
	Slaughtered	Retained ¹	Con-demned	Slaughtered	Retained ¹	Con-demned
1907 ²	5,867,642	24,876	17,117	26,189,026	362,445	48,544
1908	7,116,275	68,395	24,371	35,113,077	719,279	77,554
1909	7,325,337	100,650	24,525	35,427,931	860,425	45,113
1910	7,962,189	123,501	27,638	27,656,021	792,176	28,880
1911	7,781,030	133,551	27,186	29,916,363	1,117,789	31,517
1912	7,532,005	160,122	35,273	34,966,378	1,643,100	42,267
1913	7,155,839	152,560	33,001	32,287,538	1,809,751	47,632
1914	6,724,117	143,699	29,738	33,289,705	2,201,005	48,252
1915	6,964,502	158,239	32,644	36,247,858	2,774,835	66,023
1916	7,404,288	190,991	37,085	40,482,799	3,687,817	74,109
1917	9,299,489	218,928	46,351	40,210,847	3,978,168	76,807
1918	10,938,287	222,787	40,692	35,449,247	3,494,587	59,740
1919	11,241,991	205,698	37,600	44,398,389	4,103,376	65,837
1920	9,709,819	200,647	37,492	38,981,914	4,260,719	65,609
1921	8,179,572	173,658	33,328	37,702,866	4,693,305	64,830
1922	7,871,457	213,606	39,434	39,416,439	5,640,081	70,304
1923	9,029,536	251,299	49,839	48,600,069	7,139,925	88,688
1924	9,188,652	280,905	56,760	54,416,481	8,293,965	100,110
1925	9,773,883	322,925	61,104	48,459,608	7,039,724	86,282
1926	10,098,121	419,028	70,604	40,442,730	5,667,093	63,748
1927	10,049,589	351,716	53,512	42,650,443	5,778,009	59,656
1928	9,040,028	294,002	38,931	48,347,393	5,872,503	55,749
1929	8,284,324	244,608	31,254	47,163,573	5,408,910	46,624
1930	8,280,778	222,210	26,238	46,688,860	5,321,352	42,381

¹ Held for more complete examination to determine final disposal.

² Covers 9 months from Oct. 1, 1906, to June 30, 1907.

When animals are "retained" by the Federal inspectors on account of tuberculosis it means that some evidence of the disease is discovered and the carcass is placed aside for further examination. If the disease is found to be so slight as to render the undiseased portion of the carcass fit for food, the diseased area is removed and the remainder is passed. It will be noted that such is the case in most carcasses retained, but some loss occurs for the reason that the diseased portions found unfit for food would have a considerable value if healthy.

In the animals that are retained and when the disease is not extensive enough to cause condemnation of the entire carcass the disease is in most cases in the early stages. Had the animals been allowed to live for possibly only a short time longer the disease would have progressed until all the carcass would have to be considered diseased. In others the lesion of disease has become surrounded by tissue that "locks it up" and prevents it from spreading to other parts of the body. Such a condition, however, is liable to change at any time during the animal's life and allow the disease to enter other parts of the body, and also to be carried out of the body and endanger healthy cattle and swine.

On the farms from which these animals came, some of the remaining cattle and swine are probably affected with tuberculosis, or will be if allowed to remain there for a sufficient length of time. Knowing this danger State and Federal officials, when the identity of the animals can be established, trace back as many of the shipments of

diseased animals as possible, and through the cooperation of the owner try to exterminate the disease from that farm.

CAUSE OF TUBERCULOSIS

The direct and primary cause of tuberculosis is a rod-shaped germ which can be seen only with the aid of a microscope of high magnifying power. The presence of this germ in the bodies of human beings or livestock is absolutely necessary to produce the disease. The germs of tuberculosis may also be grown artificially in proper material at a temperature of about 98° F.

Outside the bodies of animals the organism is not capable of reproducing itself. When exposed to the direct rays of the sun it dies quickly—a fact to be noted in the disinfection of pastures,

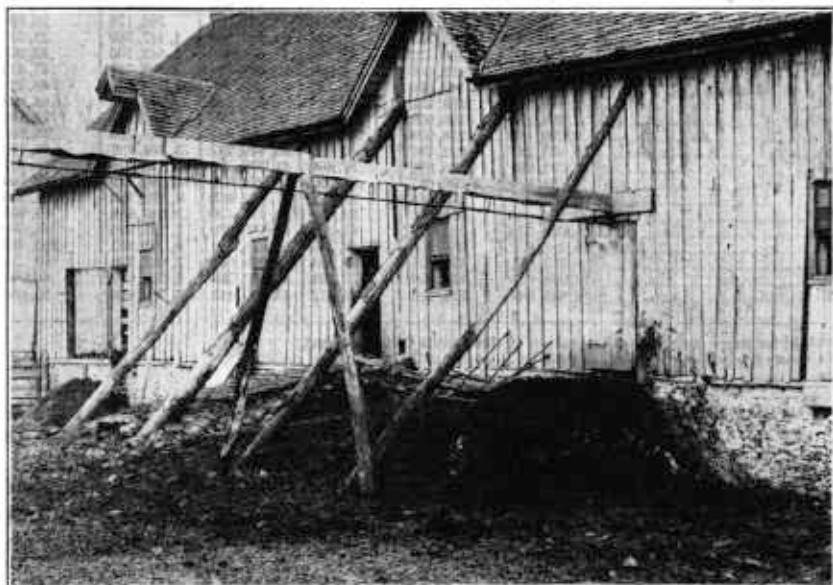


FIG. 3.—An insanitary barn. Nearly all the cows kept in it were tuberculous. The stone foundation wall retained about 2 feet of liquid manure which contained millions of tubercle germs. Premises of this character can not be kept sanitary

paddocks, and barn lots. The organism may live for months, however, when it is protected by dry manure and other materials which form a crust over it and prevent its destruction by the sun's rays. It is of extreme importance, therefore, to clean and disinfect thoroughly all barns, stalls, and other inclosures which have contained tuberculous animals, before healthy ones are again placed in them.

While it is necessary for the germs of tuberculosis to be introduced into the body of the animal before the disease can be produced, there are many conditions or accessory causes which make animals fall victims to tuberculosis.

Animals which are fed on nonnutritious feeds, as well as those that have too little feed, become weakened constitutionally and lose the power to resist the invasion of the organisms. Stabling animals in dark, poorly ventilated, and dirty barns helps to spread tuber-

culosis among the stock whenever the germs are present. (See figs. 3 and 4.) Introducing a tuberculous animal is almost sure to give the disease to healthy animals in a short time. If the healthy animals drink water from the same trough or bucket that the tuberculous animal uses, and if that animal is coughing up tuberculous sputum, all the animals are in serious danger of infection. Any condition that produces constant strain upon the systems of animals, such as the continued forced lactation periods of dairy cows, renders them fit subjects for the development of tuberculosis.

HOW CATTLE BECOME INFECTED

The tuberculous cow is the greatest source of danger to healthy cattle, and inasmuch as it can not be determined just when that animal becomes a "spreader" of the germs unless daily microscopic tests are made of the discharges from the body and the milk is also



FIG. 4.—A modern sanitary barn. Note ventilators and liberal window space

examined microscopically, it is unsafe to keep it with healthy cattle. No cattle from outside sources should be introduced into a healthy herd until they have been tuberculin tested and found free from the disease. Unquestionably more healthy cattle acquire tuberculosis by coming into contact with affected animals than in any other way. It has been observed frequently that cattle which stand on either side of or face tuberculous animals in barns are the first to contract the disease.

The continuous water trough in barns is also the cause to a very large extent of spreading the disease. Cattle may become infected by picking over manure infected with the germs of tuberculosis. Hay, straw, or any other feed contaminated with the germs may give the disease to animals that consume such material.

Water holes and creeks into which infected milk or the washings from infected milk cans have been dumped may also be a source

of the infection. The teat siphon or milking tube, in a number of instances, has been the medium by which the disease has been conveyed from one animal to another. Calves contract tuberculosis by nursing, even for a short time, cows whose udders are affected. Calves also become infected by drinking milk from diseased cattle isolated from the main herd. To be safe for feed, milk from such cows should first be heated to a temperature of 145° F. and held there for at least 30 minutes, but as this method requires considerable attention to assure proper heating, boiling for a few minutes is considered a better plan.

HOW SWINE BECOME INFECTED

The tuberculous cow is not only a menace to other cattle but is also the commonest source of infection to swine. In some parts of the country, especially where there are whole-milk creameries and skimming stations, feeding mixed skim milk to swine is a common practice. In that way the skim milk from one farm may be fed to hogs on another. Thus it is possible that milk from a few tuberculous cows may set up the infection among swine on many farms.

Milk is a good medium for the development of the tubercle bacilli, and swine seem to be extremely susceptible to tuberculosis. Numerous instances are on record also in which the whole milk is separated on the farm, the cream shipped, and the skim milk fed to swine. Consequently one tuberculous animal that is passing the germs in the milk secretions may give the disease to any or all of the animals to which any of the milk is fed. Investigations made by the Bureau of Animal Industry show that in practically every instance where tuberculosis exists among cattle, and swine are kept on the same farm, some of the latter are tuberculous. Eradication of tuberculosis from cattle, it is believed, will greatly reduce its prevalence among swine.

Another common practice of feeding, especially in the Corn Belt States, is to allow hogs to run with cattle in the feed lots or pastures. If the cattle are tuberculous and the feces contain the germs of tuberculosis, in all probability the swine will contract the disease. Swine may contract tuberculosis also by eating parts of the carcasses of infected cattle, swine, or poultry. Other sources of contamination are infected sputum from human beings, and the feeding of uncooked garbage containing the germs of tuberculosis. Tuberculous swine, like diseased cattle, may also infect one another. Recent investigations indicate that a large percentage of hogs found to be slightly affected with tuberculosis have contracted the infection from poultry.²

SYMPTOMS OF TUBERCULOSIS

It must be understood that tuberculosis is a disease which often gives no indication of its presence by external symptoms. (See fig. 1.) Yet persons skilled and experienced in dealing with the disease among animals frequently are able to detect certain abnormal conditions which lead them to pronounce the animal as probably affected with tuberculosis. A generally run-down condition, accompanied with a cough, is often considered to be an indication of tuberculosis but is not a conclusive symptom. When

² Farmers' Bulletin 1200 describes and gives information on fowl tuberculosis.

tuberculosis is suspected it is always advisable to apply the tuberculin test without delay.

As the disease often involves the lymphatic glands in various parts of the body an examination of such glands as can be felt in the living animal is sometimes helpful in diagnosing the disease. The glands of the throat, udder, and point of the shoulder often present an abnormal condition, such as an enlargement or hardening, as shown in Figure 5. Animals affected with tuberculosis in advanced stages often show a "staring" coat and a generally unthrifty condition. When the throat glands of an animal are affected it often holds its head in an abnormal position in order to relieve the pressure which causes difficult breathing. Increased

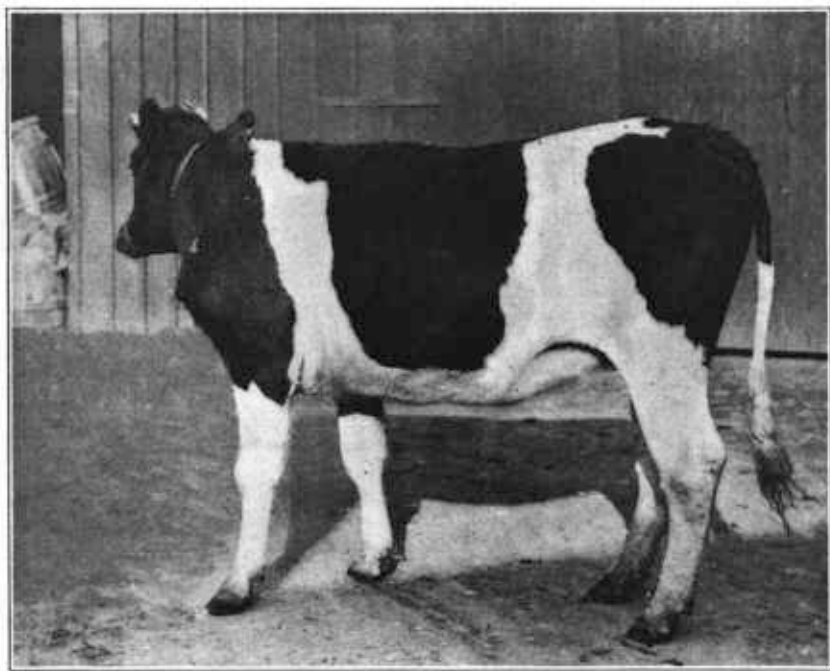


FIG. 5.—A tuberculous heifer. The gland at the shoulder was diseased and discharging tuberculous pus

respiration is often noted when the lungs or lymphatic glands of the thoracic cavity are affected. When some of the glands of that cavity are extensively diseased the animal often develops bloat (fig. 6). Diarrhea is often evident in some cases in which infection has extended to the abdominal cavity. The symptoms mentioned, though typical, must not always be expected when animals are tuberculous; animals that are extensively diseased are often in apparently perfect physical condition.

METHODS OF DIAGNOSIS

Microscopic examinations of sputum, milk, and bowel discharges of an animal are sometimes made to determine the presence of tubercle bacilli and to diagnose tuberculosis, but after many years of

experience the tuberculin test is now considered to be the most practicable and satisfactory way of discovering the disease in the living animal. The inoculation of guinea pigs with emulsions made from milk or discharges from the living animals is sometimes resorted to as a means of diagnosis, but that method of examination is technical and requires special scientific training and equipment. Besides, cases of tuberculosis may be overlooked when laboratory methods are used, because tuberculous animals do not always discharge the tubercle bacilli.

THE TUBERCULIN TEST

Testing animals with tuberculin is the process of introducing tuberculin into the animal and interpreting results according to well-

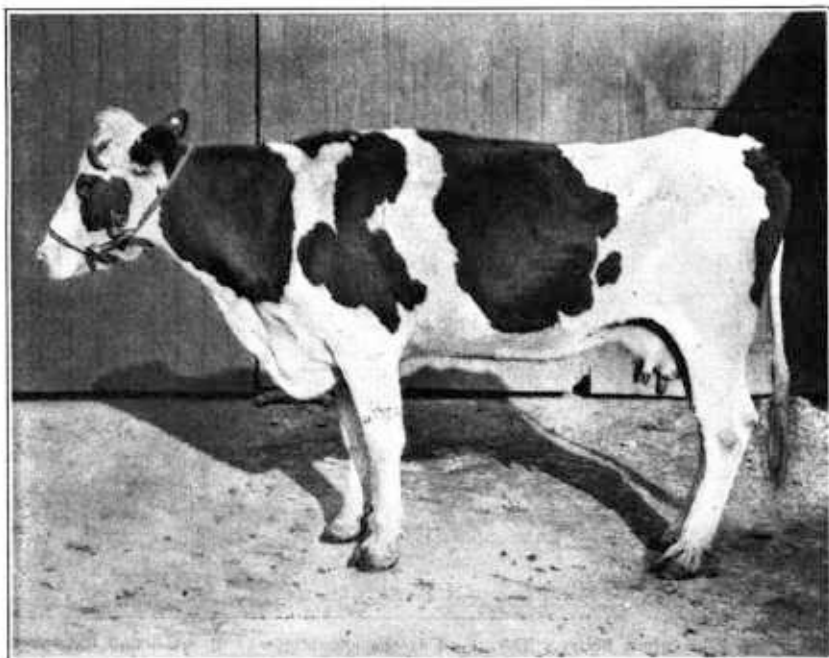


FIG. 6.—A reacting cow that was constantly "bloating." The pressure of greatly enlarged tuberculous glands on the gullet was the cause of the bloating

known standards. Tuberculin is a laboratory product prepared scientifically and, when of standard potency and in the hands of skillful persons, it is a reliable agent for detecting tuberculosis in animals. It contains no living tubercle bacilli but is a product of the growth of tubercle bacilli properly mixed with a substance on which it has grown and properly diluted and preserved. No harm can result to healthy animals from the proper application of tuberculin even if doses many times greater than the regular ones are used.

The use of tuberculin by untrained persons is to be discouraged for the reason that in many cases its effect on tuberculous animals is unobserved and not understood by those unfamiliar with its action.

Tuberculin, by its immunizing property, can cause tuberculous animals to fail to respond to its application at another time; therefore it may be misused by unscrupulous persons.

THE SUBCUTANEOUS TEST (UNDER THE SKIN)

The subcutaneous test is made by injecting the proper quantity of tuberculin underneath the skin into the subcutaneous tissue. If an animal is tuberculous, the action of the tuberculin causes a fever, which is indicated by a rise in temperature. This rise, under ordinary conditions, may occur any time between the eighth and twentieth hours after the tuberculin is injected, but in some cases it is desirable to measure the temperature before the eighth hour and continue to the twenty-fourth hour or longer.

The temperatures are measured at least three times in advance of the injection, at 2-hour intervals, to learn whether the animal is in proper condition to receive the test. The temperatures after injection are taken every 2 hours until the test is completed. The proper interpretation of the temperatures is made by the person who applies the test, and a careful observance of any clinical changes is always important in determining the result. It can not be set forth too strongly that the test, including the two following methods, should be attempted only by those who are properly qualified to do the work.

THE INTRADERMIC TEST (INTO THE SKIN)

The intradermic test for detecting tuberculosis is used extensively. When made by those who have become skilled in its application it is very accurate. In this test the tuberculin is injected between the layers of the skin, only a few drops being used, and it is usually applied in the region at the base of the tail, where the skin is soft and nearly hairless. The intradermic test is satisfactory also for the diagnosis of tuberculosis in swine, and when so used the tuberculin is applied into the skin of the ear near its base.

The reaction from the intradermic test consists of a swelling at the point of injection and is usually observed from 72 to 120 hours after the injection. The character of the swelling varies, and a proper diagnosis of tuberculosis by this test can be made only by an experienced person.

THE OPHTHALMIC TEST (INTO THE EYE)

Still another method, known as the ophthalmic, is used to some extent and has been found to be of considerable value in what is known as "check" testing; that is, it is used in connection with either of the previously described methods. Sometimes a tuberculous animal that fails to react to those tests shows evidence of the disease upon the application of the ophthalmic test. The ophthalmic tuberculin is placed in one eye and the other eye is used as a check. A reaction is indicated by a characteristic discharge from the eye receiving the treatment, which may occur in from 3 to 10 hours after the application or even later. Some swelling and inflammation of the eye and lids are often noted.

The ophthalmic test has given best results under farm conditions or in other cases where the eyes are normal. For testing cattle in transit or in the stockyard the test is less dependable, owing to the

fact that the eyes may be abnormal as the result of irritation or injury from dust, cinders, or other results of transit.

In all cases the tests, used either alone or in combination, should be applied by capable persons familiar with tuberculin testing.

POST-MORTEM APPEARANCES

Animals affected with tuberculosis may show the effects of the disease in almost any part of the body. In advanced cases the lesions are easily found, but when the disease is of recent origin or if a slightly diseased area has been encapsulated or closed up, it is often very difficult to find evidence of the disease. Lesions in advanced cases generally appear as nodules or lumps, which are tubercles formed as a result of the disease. These lumps may be found in great numbers in the lungs and abdominal organs. The lesions are of various sizes and may contain pus, either soft or hard; many times it is gritty. Tubercles are often found in various numbers attached to the walls of the thoracic and abdominal cavities. Lesions of the disease also occur in the lungs, liver, and spleen. The lymph glands, to some extent, are usually affected, and, when cut into, show diseased areas characteristic of tuberculosis.



FIG. 7.—Part of a tuberculous udder showing well-developed lesions

Lesions of the disease may be found also in the skin and in or on the bones. In animals only slightly diseased, the lesion may be hidden so that it is impossible for even a person skilled in post-mortem work to find it. A microscopic examination of the lymphatic glands or other tissues often reveals the presence of tubercle bacilli when no lesions can be seen by the naked eye, a

condition showing that the disease is just starting. When animals have reacted to the tuberculin test, a very careful post-mortem examination should be made. The action of tuberculin is often discredited when on post-mortem the lesions are not plainly seen, but experience of many years has shown that very few animals that reacted to the test were not affected with tuberculosis to some extent, even though some were very slight.

Characteristic lesions of bovine tuberculosis are shown in Figures 7, 8, and 9.

METHODS OF ERADICATION

Cattle owners who do not know whether tuberculosis exists among their animals should ascertain the fact by having them tuberculin tested and physically examined by a qualified veterinarian. In

many cases thousands of dollars and very valuable breeding animals might have been saved by taking up tuberculosis-eradication work in time.

Three main projects comprise the general campaign of eradication, as follows:

1. Eradication of tuberculosis from purebred herds of cattle.
2. Eradication of tuberculosis from circumscribed areas.
3. Eradication of tuberculosis from swine.

It is important to eradicate tuberculosis from purebred herds of cattle at the earliest possible date because the spread of the disease is greater among such animals than among grade cattle. The reason is not that purebreds are any more susceptible, but that they are shipped extensively to every part of the United States for

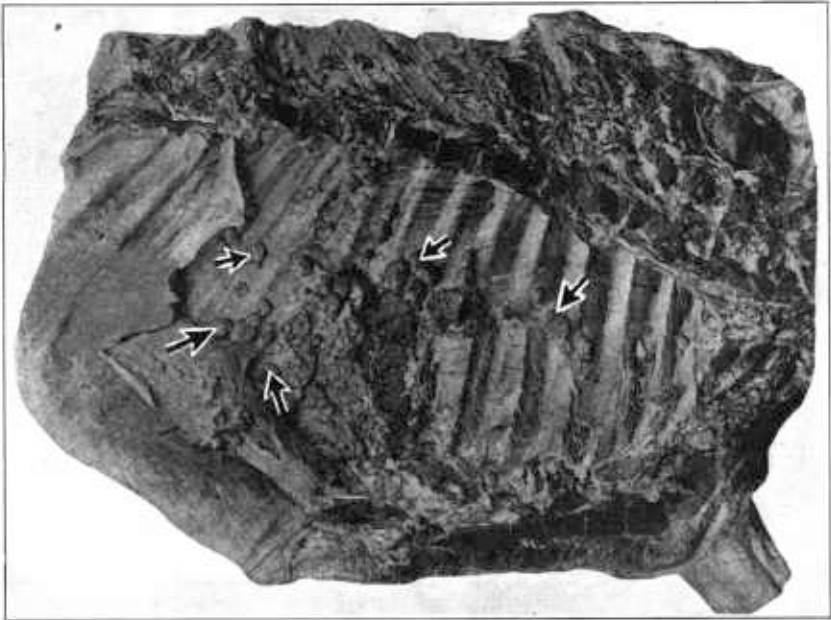


FIG. 8.—Beef carcass showing tuberculous nodules on ribs

breeding purposes. A purebred bull or cow may be shipped from Maine to Texas, or from the State of Washington to Florida. If it is diseased and is introduced into a healthy herd, it not only fails to fulfill the purpose for which it was intended—the upbreeding of the herd—but it actually causes heavy damage by spreading the disease to healthy animals. (See fig. 10.)

ACCREDITED-HERD OR HONOR-ROLL PLAN

The breeders of purebred registered cattle fully appreciated the above-mentioned fact when, together with the livestock sanitary officials of practically all the States, they adopted what is known as the accredited-herd plan, the principles of which are that herds found to be free from tuberculosis on two successive annual tests

are placed on the honor roll, and a certificate is given to the owner by the State and the Federal Government. The certificate entitles animals of that herd to be shipped interstate without further tuberculin testing for a period of one year. This plan is becoming well known to breeders throughout the United States.

The methods of eradicating tuberculosis from grade herds are, of course, the same as for purebreds. No owner can rest assured that his herd is free from tuberculosis unless it has been properly

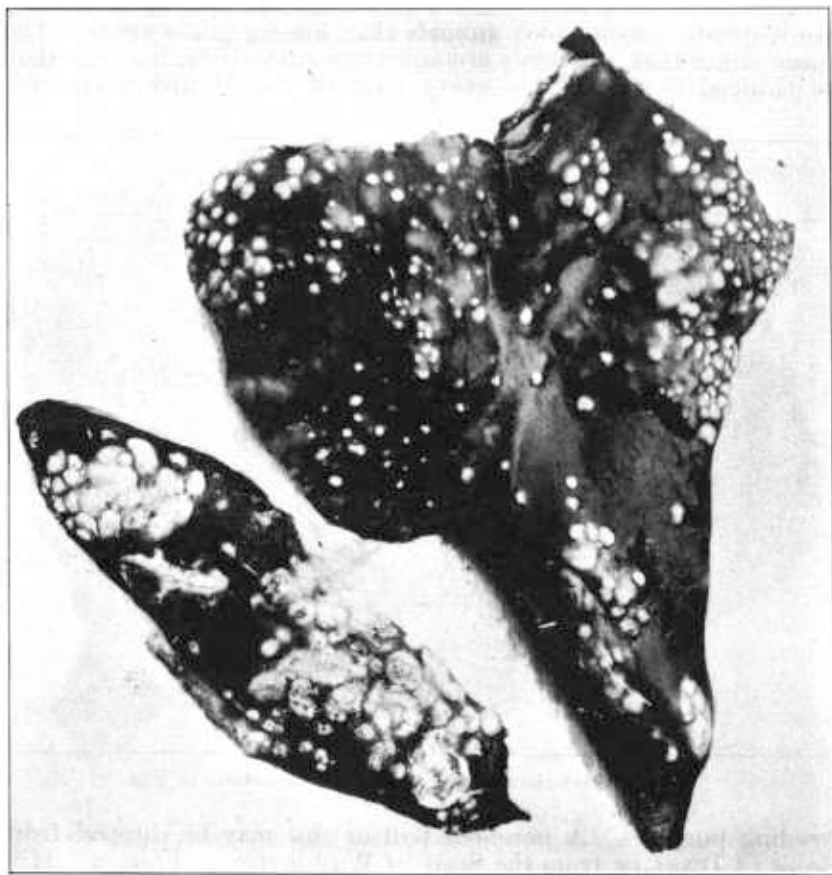


FIG. 9.—Liver and spleen showing extensive lesions of tuberculosis

tuberculin tested. Careful physical examination of each animal should be made before or during the application of the test. If animals react to the test they must be separated from the rest of the herd.

ERADICATION FROM AREAS

As a general plan, it is best to take up the work by counties, and substantial cooperation should be obtained from the county government. Each county should pay (1) part of the expense of extermi-

nating the disease by employing inspectors to make the tests, (2) part of the indemnities paid for tuberculous animals, and (3) its share of the cost of cleaning and disinfecting infected barns, stables, and sheds. When a large percentage of the herds of a county are diseased, it is advisable to clean up the herds within a township or possibly one-third or one-half of the area. The progress depends upon the degree of infection found and the cooperation furnished by the owners.



FIG. 10.—How a herd may become reinfected with tuberculosis. This herd was free from tuberculosis for a number of years. During 1917, 4 cattle were purchased in another State and placed in the herd without proper tuberculin test. When official test was made, December, 1917, 5 reactors were found. Three of the reactors were slaughtered and 2 kept in the herd. At the next test, January, 1919, 11 reactors and 2 suspects were in the herd of 28 cattle.

In 1910 the Bureau of Animal Industry took up the eradication of tuberculosis from the herds in the District of Columbia, which has an area of 60 square miles. At that time 1,701 cattle were found. Every animal was tuberculin tested; of the total number, 321 cattle, or 18.87 per cent, were tuberculous. The reactors were removed from the herds and, in most instances, were slaughtered. The infected barns, sheds, and premises were cleaned and disinfected.

Each year since the inauguration of the campaign all the cattle have been tuberculin tested, with the result that the infection has almost disappeared.

The plan of carrying on eradication under the area plan is practicable and is being conducted in many States.

Before undertaking the work in any area, large or small, the cattle owners should be consulted, and unless they are willing to lend their earnest cooperation and know the sacrifice they may have to make, it is inadvisable to start. The better the organization and the more nearly perfect the plans are made, the more efficiently the work should progress.

The intradermic method should be used, as faster progress can be made with it than with the subcutaneous test. If reactors are found in using the intradermic test, the entire herd should be tested within from 60 to 90 days, using the ophthalmic test as a check. General experience shows that it is sound practice, if there is any doubt, to use all three methods of testing with tuberculin. Such a policy is



FIG. 11.—This Hereford herd was free from tuberculosis within 3 years. The first test, in 1916, showed the herd to be 10 per cent tuberculous. The reactors were removed and in 1918 all the 62 animals in the herd were found to be healthy.

especially applicable to cattle which have been tested frequently and among herds which are or have been extensively diseased.

When not more than one-half of 1 per cent of the cattle in a given area, usually a county, are found to be affected with tuberculosis, such area is declared to be a "modified accredited area." Cattle from such areas may be moved interstate without further tuberculin test. At several of the larger markets a premium of 10 cents a hundred pounds is paid for hogs from these areas. The first counties were accredited in July, 1923, and 499 counties had been accredited up to May 1, 1928. Eradication work under the area plan is in operation in approximately 600 additional counties.

ERADICATION FROM SWINE

With the gradual elimination of tuberculosis from cattle and poultry the disease among swine will grow correspondingly smaller. It

is not necessary to tuberculin test all the swine herds because, with the exception of valuable breeding animals, it is more economical to slaughter the diseased ones when fat than to undertake to exterminate the disease in any other way.

In the case of suspected valuable purebred swine, their freedom from tuberculosis can be determined definitely by the intradermic method, which is practicable and reliable.

The injection made is near the base of the left ear; the other ear acts as a check for comparison. A reaction is manifested by a

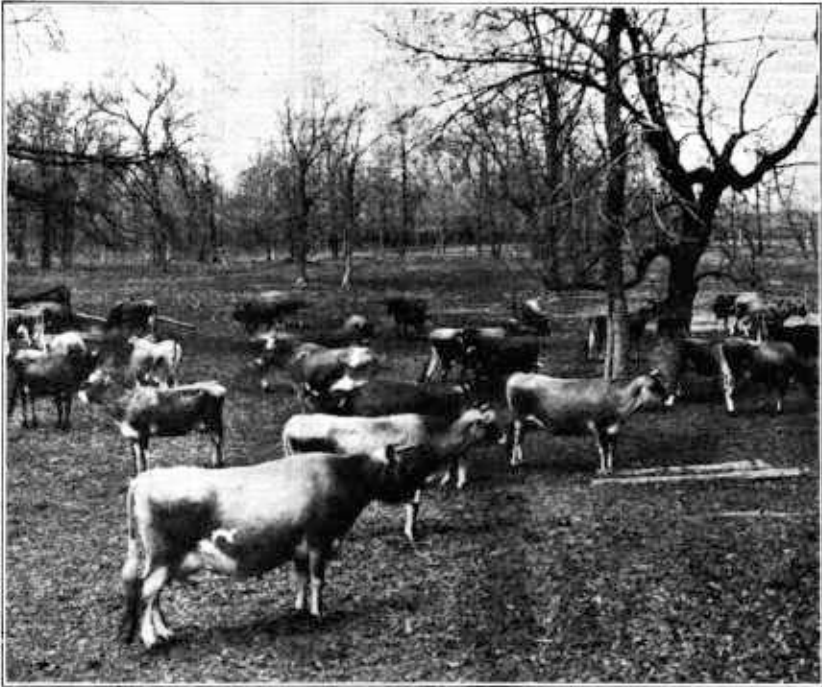


FIG. 12.—An accredited Jersey herd in Minnesota

swelling in the region where the tuberculin was injected. The swelling may appear any time from the 24th to the 104th hour after injection and will remain for several days. As in the case of cattle, diseased swine should be removed from the farm, and the sheds, farrowing houses, and the lots should be thoroughly cleaned and disinfected.

PROGRESS OF ERADICATION

The campaign for the systematic eradication of tuberculosis from livestock has met with increasing favor. Applications for testing are far in excess of the capacity of the available forces and appropriations, and there is always a waiting list of herd owners

TABLE 3.—*Status of cooperative tuberculosis-eradication work, including all herds under supervision July 1, 1930*

State	Modified accredited counties	Passed 1 test		Accredited		Under supervision	
		Herds	Cattle	Herds	Cattle	Herds	Cattle
Alabama.....	0	10, 970	83, 827	317	16, 746	13, 557	109, 753
Arizona.....	0	8, 557	103, 256	46	2, 691	8, 653	106, 138
Arkansas.....	1	12, 522	52, 364	16	786	12, 541	53, 153
California.....	5	7, 934	287, 583	147	7, 718	8, 479	348, 152
Colorado.....	0	1, 362	16, 479	185	5, 934	2, 062	32, 774
Connecticut.....	0	3, 354	15, 541	3, 293	55, 642	7, 127	79, 625
Delaware.....	1	4, 538	20, 479	1, 305	19, 244	6, 519	48, 781
District of Columbia.....	0	44	627	1	186	46	825
Florida.....	0	8, 177	96, 554	103	6, 912	9, 010	141, 665
Georgia.....	27	49, 058	174, 050	31	2, 251	49, 093	176, 400
Idaho.....	35	37, 549	426, 736	66	2, 758	40, 820	477, 585
Illinois.....	49	28, 691	202, 182	5, 575	166, 416	178, 846	1, 546, 397
Indiana.....	80	153, 981	1, 004, 327	20, 198	159, 518	176, 095	1, 186, 333
Iowa.....	54	143, 023	2, 070, 436	3, 051	78, 526	216, 919	3, 608, 104
Kansas.....	50	102, 600	1, 068, 600	657	21, 409	103, 380	1, 096, 390
Kentucky.....	43	79, 382	528, 652	41	1, 743	81, 229	551, 904
Louisiana.....	0	3, 246	61, 201	14	1, 095	3, 426	67, 472
Maine.....	16	42, 803	221, 457	961	16, 749	43, 817	238, 761
Maryland.....	1	16, 627	81, 695	9, 219	116, 318	33, 552	229, 551
Massachusetts.....	1	3, 450	32, 780	2, 172	28, 886	6, 147	69, 436
Michigan.....	82	183, 866	1, 495, 454	75	3, 653	185, 070	1, 506, 940
Minnesota.....	47	102, 248	1, 601, 234	9, 143	180, 770	112, 616	1, 798, 982
Mississippi.....	6	10, 890	146, 053	28	1, 686	10, 918	147, 740
Missouri.....	12	82, 428	720, 320	219	9, 317	86, 261	779, 228
Montana.....	113	32, 937	336, 245	62	4, 222	36, 426	584, 463
Nebraska.....	42	79, 217	1, 029, 019	125	5, 527	80, 049	1, 050, 007
Nevada.....	3	2, 277	48, 148	16	1, 005	2, 586	66, 301
New Hampshire.....	2	3, 123	26, 995	4, 625	61, 553	8, 108	92, 323
New Jersey.....	0	4, 667	14, 400	3, 832	19, 881	12, 256	44, 341
New Mexico.....	0	2, 908	23, 027	24	1, 987	3, 010	25, 052
New York.....	12	27, 800	235, 807	80, 188	788, 758	117, 626	1, 146, 880
North Carolina.....	100	256, 617	670, 554	307	10, 871	256, 924	681, 425
North Dakota.....	36	57, 114	908, 539	5, 363	109, 926	68, 872	1, 166, 404
Ohio.....	51	211, 446	1, 332, 148	828	19, 940	217, 908	1, 555, 024
Oklahoma.....	1	2, 877	44, 129	262	10, 711	3, 155	56, 284
Oregon.....	8	27, 659	208, 399	494	11, 927	28, 169	229, 403
Pennsylvania.....	31	118, 324	643, 437	6, 027	104, 409	134, 391	1, 060, 279
Rhode Island.....	0	249	2, 953	134	2, 346	713	7, 500
South Carolina.....	16	70, 461	207, 875	113	5, 068	70, 635	214, 535
South Dakota.....	5	9, 784	180, 662	1, 292	30, 976	11, 218	215, 397
Tennessee.....	13	73, 386	359, 461	133	6, 898	73, 626	371, 119
Texas.....	1	35	1, 236	426	15, 135	600	29, 698
Utah.....	1	11, 992	89, 206	99	2, 908	12, 457	85, 344
Vermont.....	(2)	2, 847	43, 186	7, 623	146, 064	12, 571	239, 082
Virginia.....	36	55, 275	213, 644	976	30, 911	56, 530	255, 946
Washington.....	15	45, 898	404, 334	89	3, 419	50, 071	517, 252
West Virginia.....	27	63, 335	667, 689	640	14, 070	65, 139	302, 689
Wisconsin.....	53	169, 626	2, 674, 221	12, 414	331, 082	186, 878	3, 131, 886
Wyoming.....	0	11, 211	125, 673	3	208	12, 576	141, 953
Alaska.....	0	89	935	0	0	102	954
Hawaii.....	0	8	0	0	0	724	17, 628
Total.....	976	2, 438, 454	20, 983, 869	182, 858	2, 646, 686	2, 919, 503	27, 692, 306

¹ Part of 1 county not included.² 43 towns.³ Parts of 2 counties not included.

MEASURES OF PREVENTION

Since, after many years of study and experience, no satisfactory cure for tuberculosis among animals has been found, prevention of the disease is extremely important. State and Federal Governments have made vigorous efforts to stop the spread of the disease by regulating the movements of cattle, and with that object in view, action has been taken in some localities to regulate the movement of cattle from one county to another. Regulation of intercounty movement should be encouraged because it brings the matter nearer home to the livestock owner. If each livestock owner takes an active part all through the campaign of tuberculosis eradication, and

if he is in favor of measures to prevent the spread of the disease and faithfully abides by those measures, eradication will be accomplished more speedily.

From what has been said already about the dangers of shipping diseased cattle, it is plain that the movement of tuberculous cattle, except for immediate slaughter or to quarantine, must be stopped whenever possible. After diseased animals are found and removed from the premises, a *very thorough* cleaning and washing of the inside of the barn and other buildings where the animals have been should be made. This must be followed by the proper application of some approved disinfectant. The use of disinfectants without first doing the necessary and proper cleaning is ineffective for the reason that the germs of the disease must be exposed. All utensils or anything else that may have become contaminated by use around the diseased animals should likewise be cleaned and disinfected. The manure and refuse must be hauled from barnyards or lots to plowed fields, spread thin, and exposed to the sunlight. The yards and lots, including feed troughs, water troughs, and fences, can then be sprayed properly with the disinfectant.

All this means much work, but it must be done to prevent infection from spreading to the healthy animals. Proper sanitary conditions on premises where livestock are kept is of great importance in keeping the animals healthy and able to resist disease. Sanitation, in its broad sense, includes the admission of abundant sunlight and fresh air properly regulated.

TABLE 4.—Progress of cooperative tuberculin testing, 1917–1930

Fiscal year	Herds tested	Cattle tested	Reactors found	Per cent reactors
1917		20, 101	645	3.2
1918		134, 143	6, 544	4.9
1919		329, 878	13, 528	4.1
1920	40, 348	700, 670	28, 709	4.1
1921	86, 687	1, 366, 358	53, 768	3.9
1922	195, 220	2, 384, 236	82, 569	3.5
1923	296, 138	3, 460, 849	113, 844	3.3
1924	455, 034	5, 312, 364	171, 559	3.2
1925	607, 345	7, 000, 028	214, 491	3.1
1926	774, 728	8, 650, 780	323, 084	3.7
1927	871, 561	9, 700, 176	285, 361	2.9
1928	1, 048, 277	11, 281, 490	262, 113	2.3
1929	1, 030, 679	11, 683, 720	206, 764	1.8
1930	1, 102, 423	12, 845, 871	216, 932	1.7

MARKING ANIMALS FOR IDENTIFICATION

It is very important to mark properly all cattle which react to the tuberculin test, so that they may be easily identified. One method that is quite generally used is that of branding; a letter "T" about 2 inches high is branded on the left lower jaw. In addition to the branding, the reacting animals should be properly tagged so that each one may be positively identified, and in that way the results of the post-mortem examination can be connected up with the reporting of the tuberculin tests. The tag is usually placed in the left ear of the animal and contains a serial number as well as the word "Reactor."

The marking of cattle that have passed the tuberculin test is a matter that is being handled in different ways throughout the United

States. In some cases a metal ear tag is used and in others certain marks of identification are tattooed in the ear. It is not often necessary to require special marks on purebred registered cattle, as the owner usually has a method of identification, and this method of marking can be used in connection with the tuberculin test as a record; but on grade animals it is desirable to use some system of marking to show that the cattle have been tested and found apparently free from tuberculosis.

A system of marking swine to show the origin of those found to be tuberculous on post-mortem examination consists in tattooing a number or mark of identification into the skin of the hog. The method is fully described in Miscellaneous Circular 57, "The Tattoo Method of Marking Hogs and Its Use."

Many shipments which contain tuberculous swine are traced back to the farm by a system of reports kept by the Bureau of Animal Industry. By developing the methods of tracing tuberculous cattle and swine from the abattoir back to the farm where they were raised, efforts can be directed in eradicating the disease from these herds.

APPRAISEMENT AND INDEMNITY

In addition to the various benefits derived from eradicating tuberculosis, provision for the appraisal of diseased cattle with indemnity for those slaughtered is a further incentive. Federal legislation and supplementary laws in numerous States now divide the burden of loss, so that the Government, the State, and the owner of the cattle all bear a share of it. Briefly, the Federal law provides that the Secretary of Agriculture may reimburse, in part, owners of animals destroyed on account of tuberculosis in cooperation with States, counties, and municipalities. The bases upon which Federal indemnities are paid are:

1. No payment shall exceed one-third of the difference between the appraised value of such animal and the salvage value.
2. No payment shall exceed the amount paid or to be paid by the State, county, or municipality.
3. In no case shall any payment be more than \$35 for any grade animal or more than \$70 for any purebred animal.
4. No payment shall be made unless the owner has complied with all lawful quarantine regulations.

Legislation regarding indemnities for tuberculous cattle varies somewhat in different States, and for detailed and current information on the subject the reader is referred to his State livestock sanitary officials or to the inspector in charge representing the Bureau of Animal Industry in cooperative tuberculosis-eradication work. The names and addresses of these officials may be obtained by addressing the Bureau of Animal Industry, U. S. Department of Agriculture.

A careful study of Figures 5, 7, 8, and 9 in this bulletin will enable the reader to become familiar with the appearance of the parts of the body most commonly affected. He will also see, even more clearly than can be described, that a real danger exists in permitting diseased animals or those of doubtful health to mingle with others. The illustrations of the accredited herds, on the other hand, show the splendid types of cattle which their owners have subjected to the tuberculin test and which have passed it successfully.

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